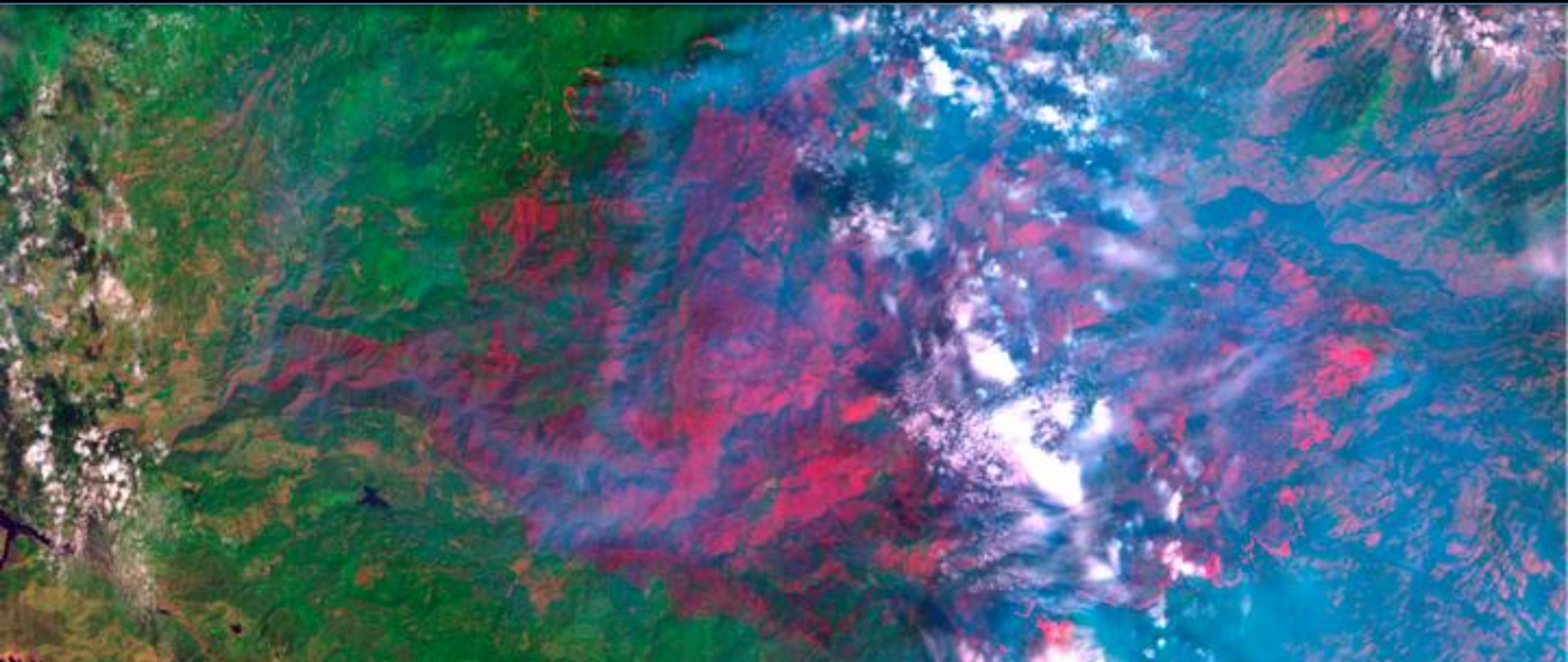




NASA UPDATE



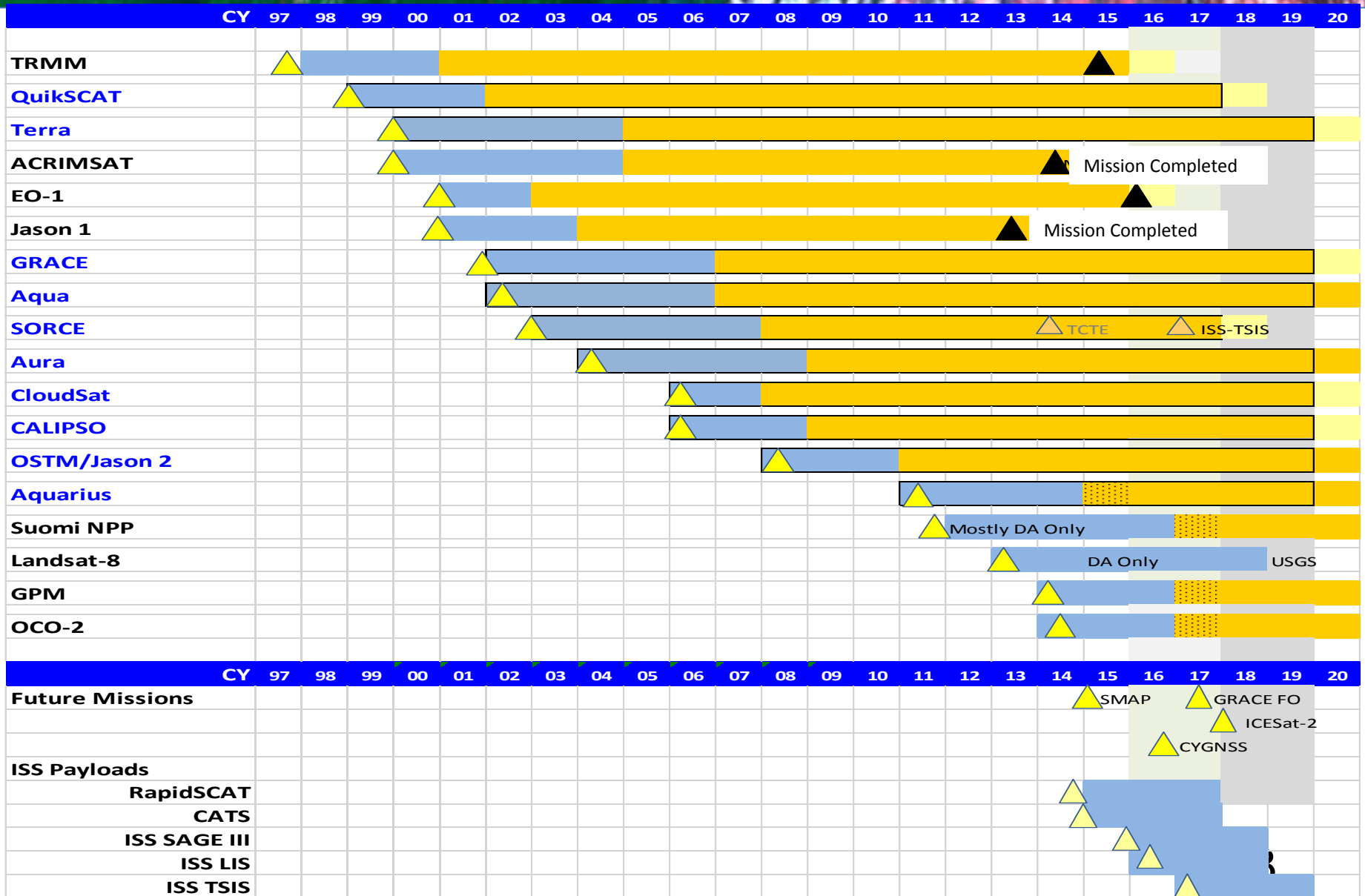
JACIE 2015, 5 May 2015

Bradley Doorn
NASA Earth Science Division

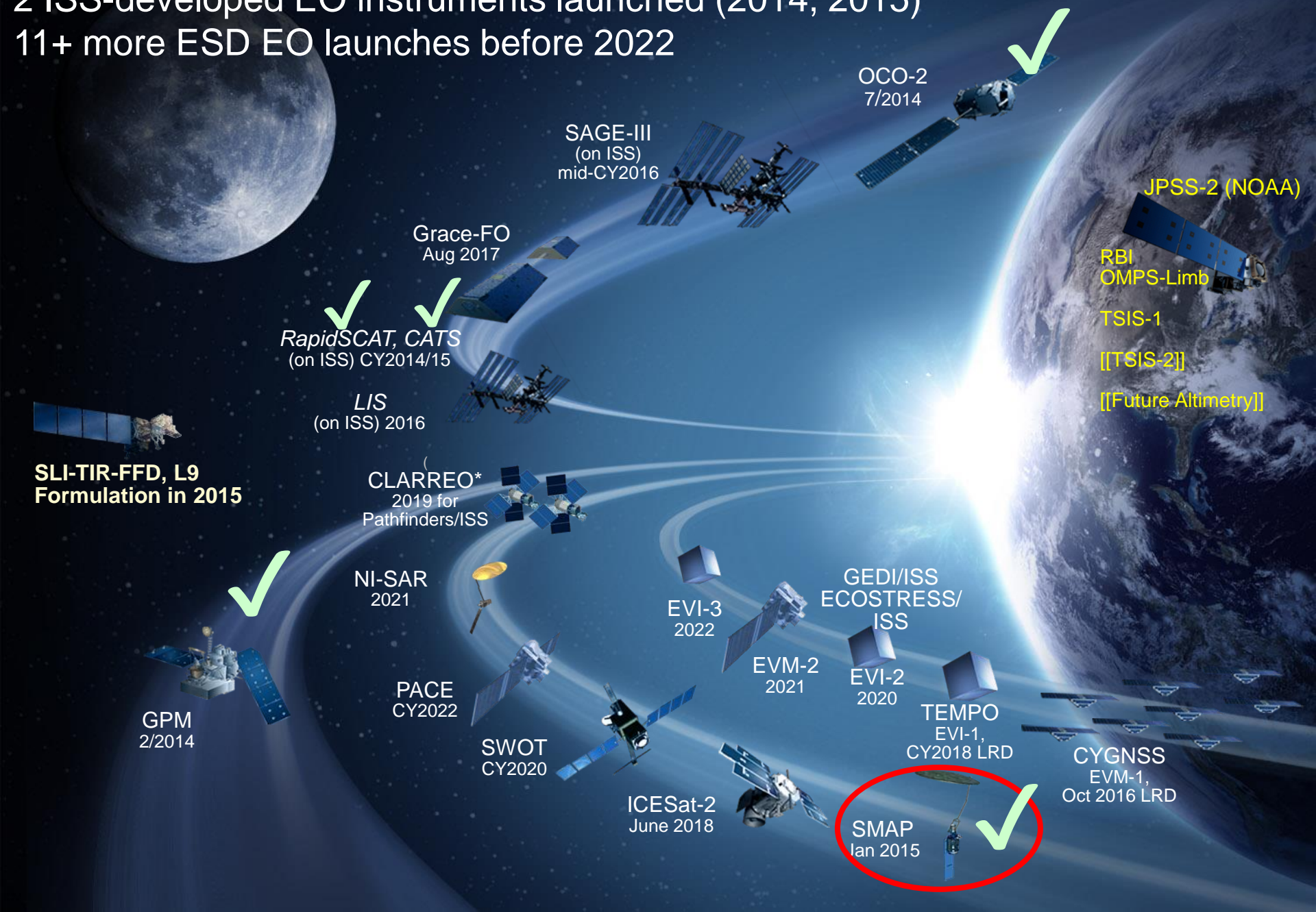


ESD 2015 Senior Review Mission Set

Prime
Extension
Phase F

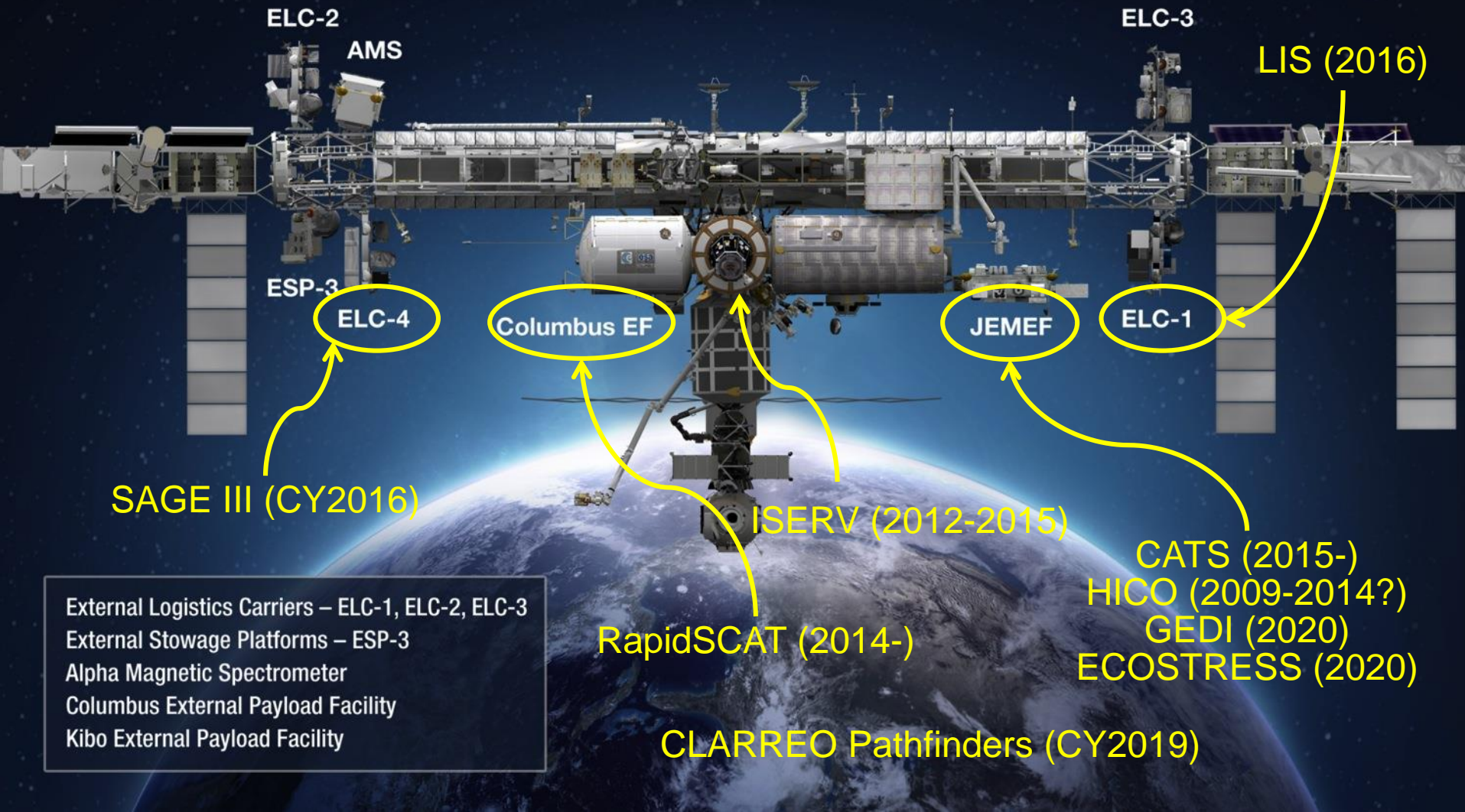


3 ESD-developed EO missions launched since 2/2014
2 ISS-developed EO instruments launched (2014, 2015)
11+ more ESD EO launches before 2022



International Space Station

Earth Science Instruments



External Logistics Carriers – ELC-1, ELC-2, ELC-3
External Stowage Platforms – ESP-3
Alpha Magnetic Spectrometer
Columbus External Payload Facility
Kibo External Payload Facility

CATS (2015-)
HICO (2009-2014?)
GEDI (2020)
ECOSTRESS (2020)

CLARREO Pathfinders (CY2019)

2016 NASA Budget Summary



Earth Science

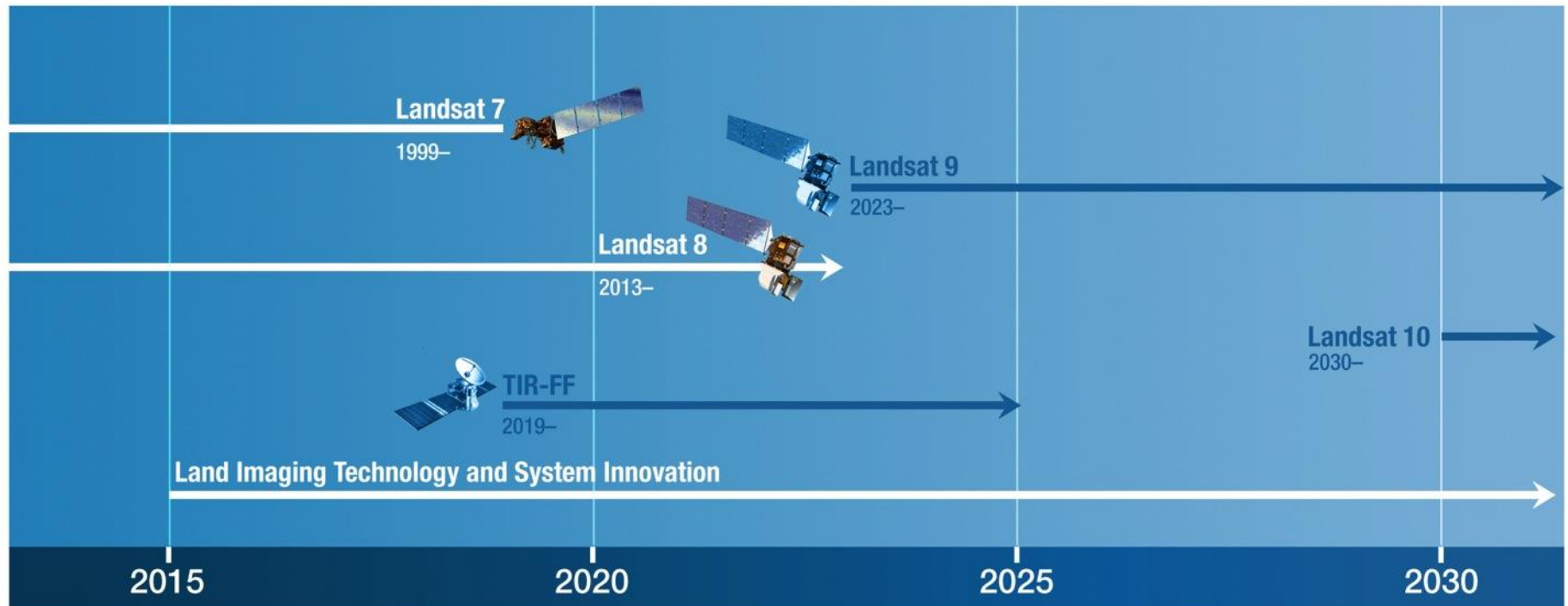
(\$M)	Outyears are notional				
	2016	2017	2018	2019	2020
Earth Science	\$1,947	\$1,967	\$1,988	\$2,009	\$2,027

- Supports formulation and development of PACE, NISAR, OCO-3, ICESat-2, GRADE Follow-on, and SERVOT.
- Multi-Decadal Sustainable Land Imaging (SLI) program provides high-quality, global land imaging measurements, involving Thermal-Infrared Free-Flyer (TIR-FF), Landsat 9 (full Class-B rebuild of Landsat 8), and Land Imaging Technology and System Innovation.
- Transfers TSIS-1 and future ocean altimetry missions (after Jason-3) from NOAA to NASA, consistent with a revision of satellite responsibilities in which NOAA retains responsibility for weather satellites and NASA is the lead for other nondefense Earth-observing satellite missions.
- Supports the Venture Class Suborbital-2 investigation selections.
- Provides strong support for Research and Analysis.
- Operates 18 additional missions, and the Airborne Science project.

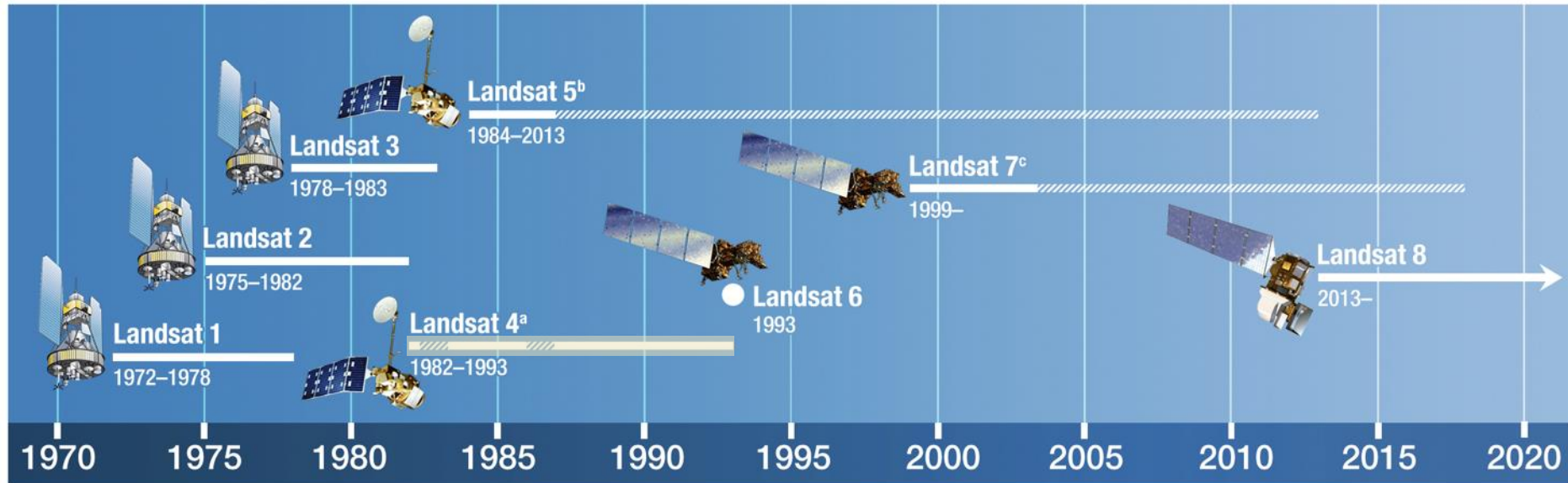


- ✧ The 3+1 part program, with the essential investments in technology and observational innovation to ensure a world class, sustainable, and responsible land imaging program through 2035:
 1. Class D Thermal Infrared Free Flyer (TIRFF_D) to launch ASAP (estimated NLT 2019) and to fly in constellation with a reflective band imager
 - Low cost mitigation against an early loss of the Landsat 8 Class C TIRS, while demonstrating feasibility of constellation flying
 2. Landsat 9 (Full Class B Rebuild of Landsat 8) to launch in 2023
 - Low programmatic risk implementation of a proven system with upgrades to bring the whole system to Class B
 3. Sustained Technology and Systems Innovation (e.g., ACMS, hyperspectral)
 - Conducts hardware, operations and data management/processing investments to reduce risk in next generation missions.
 4. Landsat 10, Class B full spectrum, launch in 2030
 - Mission definition to be informed by the Technology investments in 2015 – 2018, leading to a key decision point around 2019

Sustainable Land Imaging (SLI) Architecture



Landsat History



^aLimited data due to transmitter failure soon after launch. Only 45,172 Landsat 4 Thematic Mapper scenes from 1982-1993 available for science users—~10 scenes/day (vs 725 scenes/day from L8)

^bData coverage limited to Continental US (CONUS) and International Ground Station sites after a transmitter failure in 1987; Multispectral Scanner turned off in August 1995

^cDegraded Performance due to Scan Line Corrector failure in May 2003

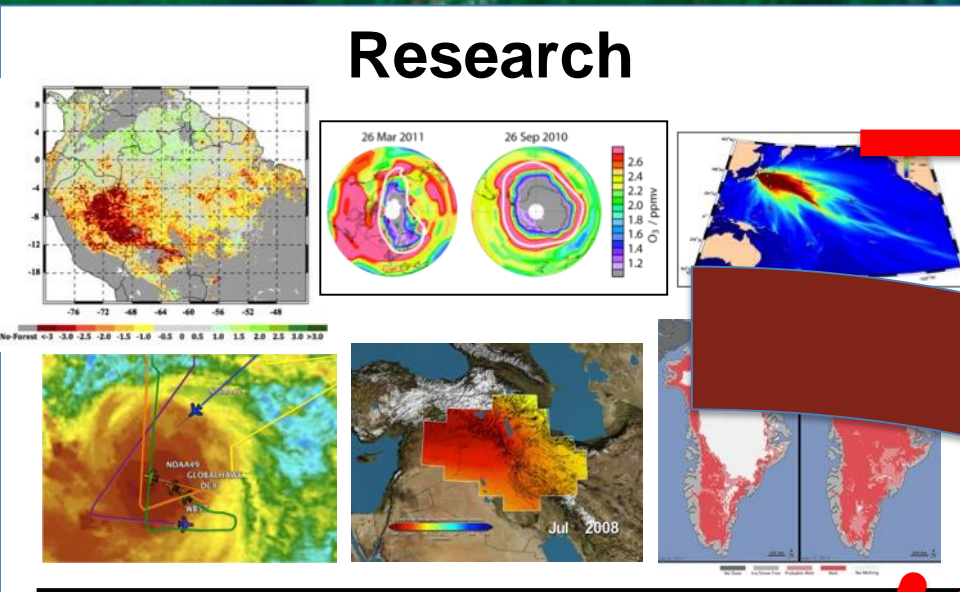
- The Landsat program began as the Earth Resources Technology Satellites Program in 1966, with Landsat 1 (ERTS) launched in July 1972
- NASA built and launched Landsats 1-5 and Landsats 7-8
- Thermal band added for Landsats 3 and beyond
- After launch, Landsat operations are transferred from NASA to USGS, and USGS collects, archives, processes, and distributes the image data via the internet at no cost to users
- Landsat 8 began as a data purchase and became known as the Landsat Data Continuity Mission (LDCM)
 - Although the thermal bands were originally not incorporated in the mission, they were added back into the Observatory's capabilities following strong support from a variety of stakeholders

NASA's Earth Science Division

Research

The collage consists of several research-related images:

- Top Left:** A map of South America showing vegetation indices. A color scale at the bottom ranges from -3.0 (No Forest) to 3.0 (>3.0).
- Top Center:** Two polar projection maps of the Arctic region showing O₂/ppmv concentrations. The left map is dated 26 Mar 111 and the right map is dated 26 Sep 1010. A color scale on the right ranges from 1.2 to 2.6.
- Top Right:** A map of the North Atlantic showing a large red area.
- Middle Left:** A map of the North Atlantic showing a large red area.
- Middle Center:** A map of the North Atlantic showing a large red area.
- Middle Right:** A map of the North Atlantic showing a large red area.
- Bottom Left:** A map of the North Atlantic showing a large red area.
- Bottom Center:** A map of the North Atlantic showing a large red area.
- Bottom Right:** A map of the North Atlantic showing a large red area.



Flight

ESD Operating Missions (2013)

Planned Missions (2013-2023)

ESD/SAGE III (2014)

ISS Rapsat (2014)

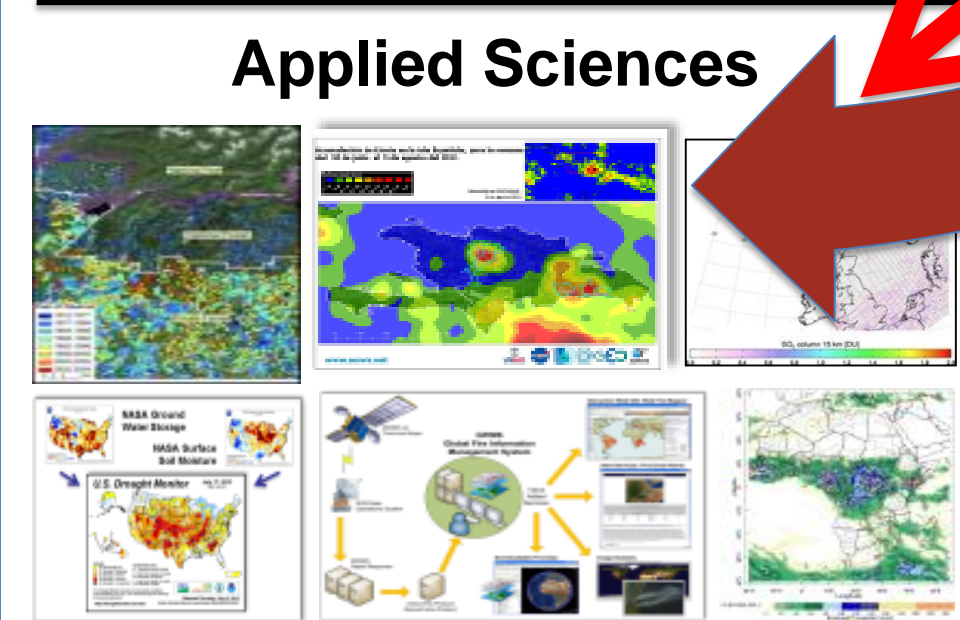
ISS/COCC-3 (2017)

ISS/CATS (2014)

ISS/SCO (2009)



Applied Sciences



Technology



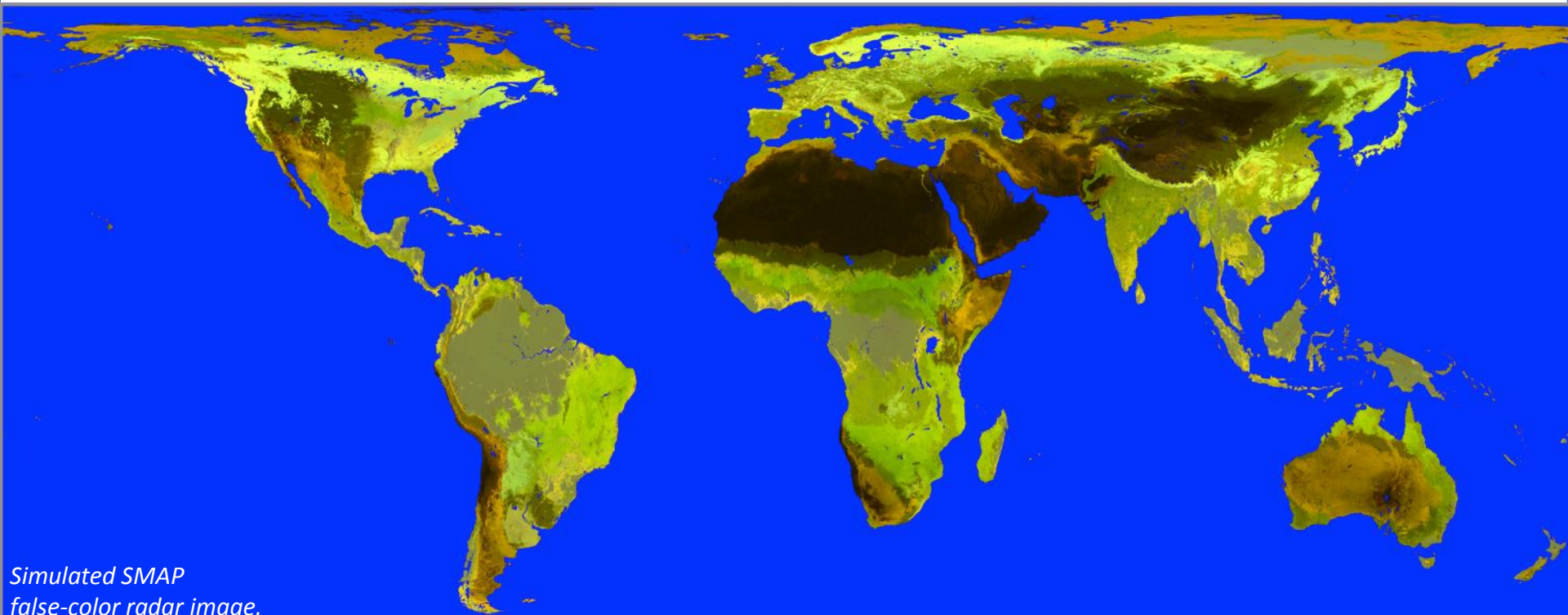
The collage consists of six images arranged in a 3x2 grid:

- Top Left:** A person wearing blue gloves is working on a small electronic component on a workbench.
- Top Center:** A close-up of a green printed circuit board (PCB) with gold-colored connectors and a coin for scale.
- Top Right:** Two people in winter gear are standing in a snowy mountain landscape, with one person operating a camera on a tripod.
- Bottom Left:** A large, complex electronic device, possibly a camera or sensor, mounted on a metal frame.
- Bottom Center:** A close-up of a large, circular, gold-colored component, likely a camera lens or sensor, mounted on a white structure.
- Bottom Right:** A blue and white aircraft flying over a snowy, mountainous landscape.



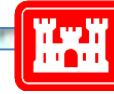
SMAP Applied Research

- Engage users early in mission development
- Improve data delivery to users
- Incorporate community feedback



*Simulated SMAP
false-color radar image,
January - GloSim2*

48 Early Adopters



JOHN DEERE



Agriculture and Agri-Food Canada



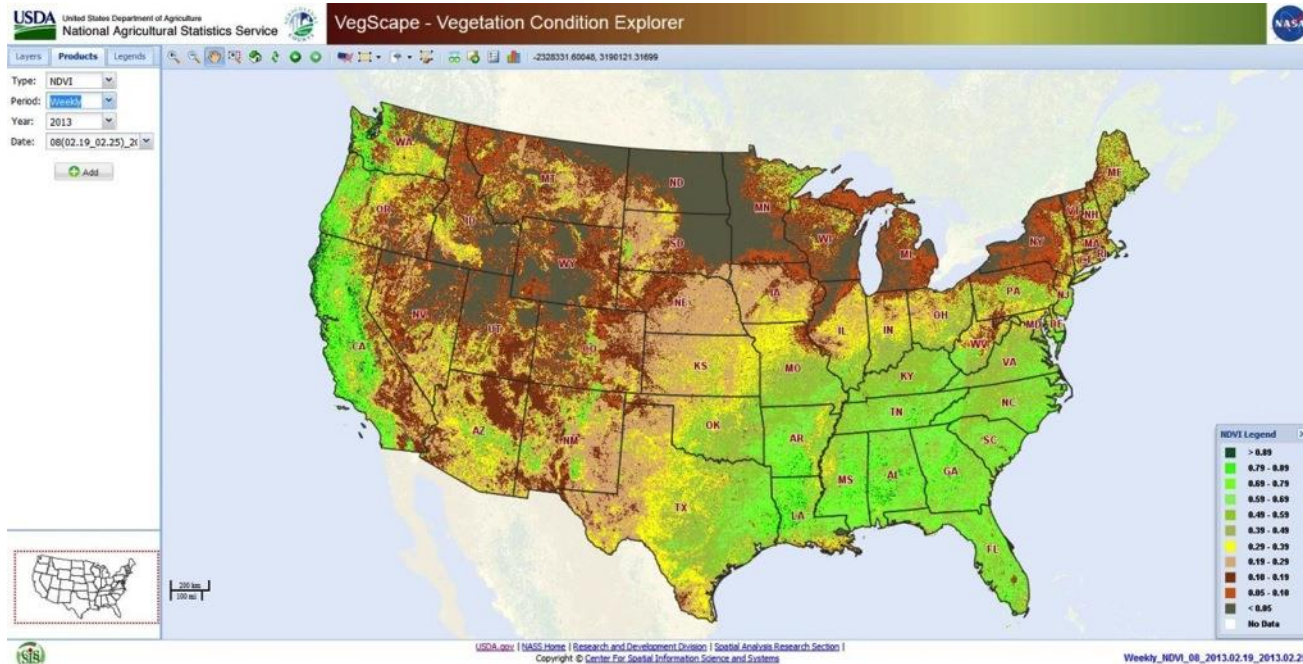
Uses Spanning Agriculture, Weather, Emergency Response, Human Health, and Military Readiness



National Soil Moisture Modeling

Zhengwei Yang and Rick Mueller, USDA National Agricultural Statistical Service (NASS); SMAP Contact: **Wade Crow**

US National cropland soil moisture monitoring using SMAP



- The USDA National Agricultural Statistical Service (NASS) has launched a web-based U.S. crop vegetation condition assessment and monitoring application: VegScape (<http://nassgeodata.gmu.edu/VegScape/>).
- This web-based application has been designed to be a platform for accessing, visualization, assessing and disseminating crop soil moisture condition derivative data products produced using SMAP data.

SWOT Applications

<https://swot.jpl.nasa.gov/applications/>

APPLICATIONS

NASA and CNES, along with our Canadian and UK space agency partners, are developing a mission to make the first global survey of Earth's surface water. The SWOT mission with its wide swath altimetry technology will be able to cover most of the world's ocean and freshwater bodies with repeated high resolution elevation measurements, providing observations of fine details of the ocean's surface topography, and measuring how water bodies change over time.

NASA's [Applied Sciences Program](#), along with the SWOT project team, are implementing a strategy that promotes applications research and engages a broad community of users in the uses of SWOT data. This mission is being developed in response to recommendations of the National Research Council Decadal Survey report ([Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond](#), Space Studies Board, National Academies Press, 2007). There is a developing need for the applied science community of practice to become part of the flight mission development process, from inception through launch and operations. The end goal is to integrate this community that will eventually utilize science and data products in addressing societal issues and needs.



[SWOT Applications Plan](#) (PDF, 864 KB)



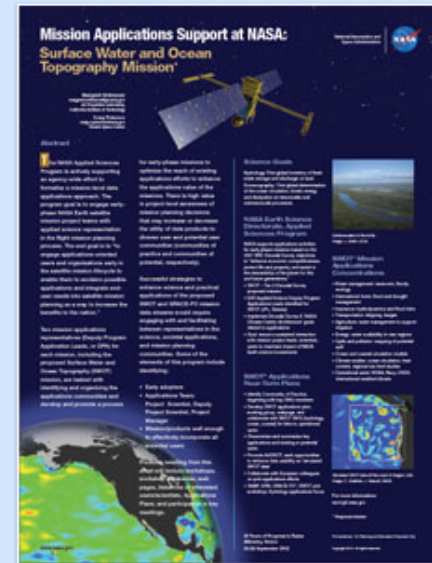
[SWOT Early Adopters Guide](#) (PDF, 446 KB)

The goals of the SWOT applications program include:

- Promote the use of SWOT products to a community of end-users and decision makers that understand SWOT and related mission capabilities and are interested in using SWOT data products in their application
- Facilitate feedback between SWOT user communities and the SWOT project
- Provide information on collaborations with different types of users and communities including those of ocean research, ice and drought studies, agricultural impacts, operational oceanography, and others
- Design communication strategies to target and support requirements of the user community

Technical information about SWOT science and capabilities can be found [here](#).

Visit the [CNES Applications page](#) on the Aviso web site.



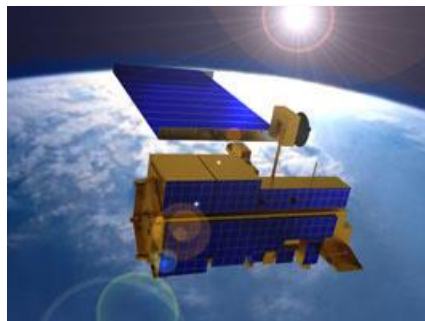
Download the [SWOT Applications Poster](#) (PDF, 4.63 MB)



NASA Satellite Irrigation Management Support: Mapping Crop Water Requirements to Assist Growers in Optimizing Water Use



PROJECT TEAM: NASA Ames Research Center, California Dept. of Water Resources, Western Growers Association, California State University, Univ. of California Cooperative Extension, Desert Research Institute, USDA Ag. Research Service, USGS, Booth Ranches, Chiquita, Constellation Wines, Del Monte Produce, Dole, E & J. Gallo, Farming D, Fresh Express, Pereira Farms, Ryan Palm Farms



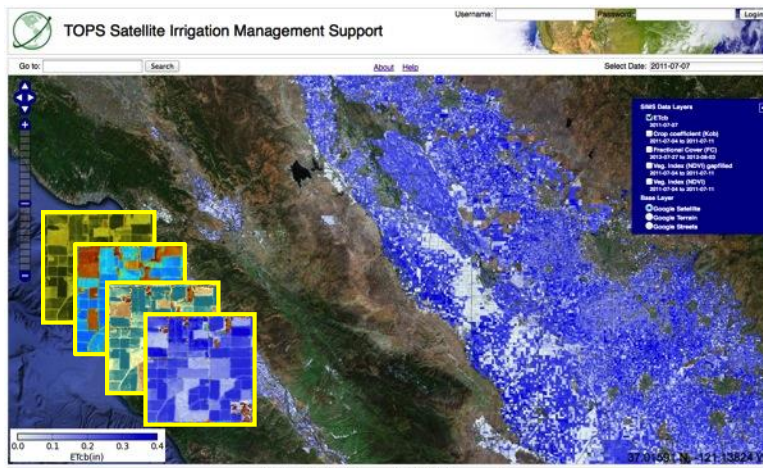
Terra Satellite



Landsat 8



California agricultural sector produced \$46.4b In 2013



NASA SIMS web and mobile data services puts irrigation demand across 8 million acres of farm land directly into the hands of farmers and water managers



Students work hand in hand with growers to validate the system and quantify benefits

For more information, contact forrest.s.melton@nasa.gov, or visit <https://c3.nasa.gov/water/projects/1/>



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